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Air Products

Industrial Gas Division

Carbon Dioxide Material Safety Data Sheet

DPM 5476

EMERGENCY PHONE: 800—523-9374 IN PENNSYLVANIA: 800—322-9092	TRADE NAME AND SYNONYMS Carbon Dioxide, Dry Ice (solid only)	CHEMICAL NAME AND SYNONYMS Carbon Dioxide, Carbonic Anhydride, Carbonic Acid Gas
ISSUE DATE AND REVISIONS Issued: 1 November 1977 Rev: 16 February 1981	FORMULA CO_2 MW: 44.01	CHEMICAL FAMILY Nonmetallic Oxides

HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
TLV = 5000 ppm [TLV-STEL (Short Term Exposure Limit) = 15000 ppm (1.5% by vol.)]

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED
Carbon dioxide does not support life and may produce immediately hazardous atmospheres. At a concentration in excess of 1.5%, carbon dioxide may produce hyperventilation, headaches, visual disturbances, tremor, loss of consciousness and death. Symptoms of exposure in the concentration ranges of 1.5-5% may be highly variable, but typical symptoms of carbon dioxide intoxication include the following:

CO_2 Concentration	Symptoms
3-6%	headaches, dyspnea, perspiration
6-10%	Headache, dyspnea, perspiration, tremors, visual disturbance, unconsciousness
Over 10%	Unconsciousness

If the concentration of carbon dioxide exceeds 10%, unconsciousness can occur without warning, preventing self-rescue. At much higher concentrations, carbon dioxide displaces the oxygen in air below levels necessary to support life.

TOXICOLOGICAL PROPERTIES
Carbon dioxide is a minor but important constituent of the atmosphere, averaging about 0.03% or 300 ppm by volume. At higher concentrations it affects the respiratory rate. Additional symptoms are described above.

RECOMMENDED FIRST AID TREATMENT
Persons suffering from the toxic effect of carbon dioxide should be moved to areas with normal atmosphere. SELF-CONTAINED BREATHING APPARATUS MAY BE NECESSARY TO PREVENT TOXIC EXPOSURE OR ASPHYXIATION OF RESCUE WORKERS. Assisted respiration and supplemental oxygen should be given if the victim is not breathing. Frozen tissues should be flooded or soaked with tepid water (105-115F; 41-46C). DO NOT USE HOT WATER. Cryogenic burns which result in blistering or deeper tissue freezing should be seen promptly by a physician.

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	AUTO IGNITION TEMP	FLAMMABLE LIMITS	LEL	UEL
N/A	N/A	N/A	N/A	N/A

EXTINGUISHING MEDIA
Carbon dioxide is an extinguishing agent for Class B & C fires.

ELECTRICAL CLASSIFICATION
GROUP N/A

SPECIAL FIRE FIGHTING PROCEDURES
N/A

UNUSUAL FIRE AND EXPLOSION HAZARDS
N/A

PHYSICAL DATA

BOILING POINT (°F.) (Sublimes)	FREEZING POINT (°F.)
@ 1 atm -109.3F (-78.5C)	@ 76 psia -69.9F (-56.6C)
VAPOR PRESSURE (psia)	SOLUBILITY IN WATER
@ 68F (20C) 831 psia (56.5 atm)	@ 68F (20C), 1 atm 87.8% by volume

VAPOR DENSITY (lb/cu ft)	SPECIFIC GRAVITY (AIR = 1)	LIQUID DENSITY (lb/cu ft)	SPECIFIC GRAVITY (H_2O = 1)
@ 68F (20C), 1 atm 0.115	@ 68F (20C), 1 atm 1.53	@ -35F (-37C), 11 atm 68.74	solid@ -110F (-79C), 1 atm 1.56

APPEARANCE AND ODOR
Carbon dioxide is colorless and odorless as gas or liquid. It is stored in containers under its own vapor pressure. If the pressure is suddenly relieved, the liquid rapidly cools as it evaporates and sublimes, forming dry ice at -109.3F (-78.5C)

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REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		
	STABLE	X	None

INCOMPATIBILITY (Materials to avoid)
If moisture is present, materials must resist carbonic acid.

HAZARDOUS DECOMPOSITION PRODUCTS
None

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	X	None

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Carbon dioxide in small quantities will vaporize leaving behind carbon dioxide "snow" (a combination of dry ice and water ice where atmospheric moisture is present). Ventilate indoor areas well to avoid hazardous carbon dioxide concentrations. Ventilate well and avoid contact with cold vapors or dry ice. Carbon dioxide is a heavy gas and will remain in low spots without assisted ventilation.

WASTE DISPOSAL METHOD
Do not attempt to dispose of residual carbon dioxide in compressed gas cylinders. Return cylinders to Air Products with residual pressure, the cylinder valve tightly closed, and the valve cap in place. When disposing of bulk quantities of carbon dioxide from refrigerated storage tanks, always dispose of carbon dioxide outside, in a well ventilated location away from work areas, where vapors can disperse. Vent to the atmosphere slowly since rapid depressurization of the container will cause the formation of solid carbon dioxide (dry ice) internally, requiring longer periods to vaporize.

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)
Use self-contained breathing apparatus in oxygen-deficient atmospheres or where carbon dioxide exceeds 1.5%. CAUTION! Respirators will not function. Use may result in asphyxiation.

VENTILATION	LOCAL EXHAUST	SPECIAL
Natural or mechanical where gas or vapors are present.	May be useful at point sources of CO_2 vapors.	
	MECHANICAL (General) Where low lying areas are not naturally ventilated	OTHER Vents should be situated to avoid higher than normal concentration of carbon dioxide in work areas.

PROTECTIVE GLOVES
Use loose fitting gloves or impermeable material such as leather when working with cold liquid, solid, or vapor.

EYE PROTECTION
Safety glasses are recommended when handling high-pressure cylinders and in areas where vapors are discharged.

OTHER PROTECTIVE EQUIPMENT
None

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION
Carbon dioxide shipment must be in accordance with Department of Transportation (DOT) regulations using the DOT "NON-FLAMMABLE GAS" label. Consult DOT regulations for details on the shipping of hazardous materials.

SPECIAL HANDLING RECOMMENDATIONS
Prevent contact of liquid CO_2, cold vapors, or carbon dioxide "snow" with exposed skin. Prevent entrapment of liquid in closed systems. Use only in well ventilated areas. Compressed gas cylinders contain gaseous and liquid carbon dioxide at extremely high pressure and should be handled with care. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Secure cylinders when in use. Never use direct flame to heat a compressed gas cylinder. Use a check valve to prevent backflow into storage container. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS
Store liquid containers and cylinders in well ventilated areas. Keep cylinders away from sources of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Segregate full and empty cylinders. Storage areas should be free of combustible material. Avoid exposure to areas where salt or other corrosive chemicals are present. Store carbon dioxide cylinders with the valve end up. See Compressed Gas Association Pamphlet P-1 for additional storage recommendations.

SPECIAL PACKAGING RECOMMENDATIONS
Carbon dioxide containers meet Department of Transportation (DOT) specifications or American Society of Mechanical Engineers (ASME) codes.

OTHER RECOMMENDATIONS OR PRECAUTIONS
In applications where temperatures less than -20F (-29C) are expected, avoid the use of carbon steel and other materials which become brittle at low temperatures. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder filled without the permission of the owner is a violation of Federal Law. The atmosphere in areas in which CO_2 gas may be vented and collect should be tested with a portable or continuous monitoring CO_2 gas analyzer.

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that he is in full compliance.